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A Review of Improvement in Engineering Properties of Expansive Soil Using Rice Husk

Sonu Chauhan[1], Ushendra Kumar[2]
Dept. of Civil Engineering,
Lucknow Institute of Technology, Lucknow, India

Abstract— **This review paper clarify about the rapid urbanization in india is creating a shortage of sustainable construction sites with good soil conditions. Attempts have been made to use rice husk ash (RHA) in concrete industry of india, however, limited literature is available on its potential to improve local soils. This paper presents an experimental study on engineering properties of low and high plastic cohesive soils blended with 0-20% RHA by dry weight of soil. The decrease in plasticity index and shrinkage ratio indicates a reduction in swell potential of RHA treated cohesive soils which is beneficial for problems related to placing pavements and footings on such soils. It is also observed that the increased formation of pozzolanic products within the pore spaces of soil from physicochemical changes transforms RHA treated soils to a compact mass which decreases both total settlement and rate of settlement. A notable increase in friction angle with increase in RHA up to 16% was also observed in direct shear tests. It is concluded that RHA treatment is a cost-effective and sustainable alternate to deal with problematic local cohesive soils in agro-based developing countries like india.**

Keywords: sustainable construction, soil, physicochemical changes, cost-effective, local cohesive soils.

1. INTRODUCTION

Ordinary In India, 'Black cotton soils' covers almost one fifth(1/5th)to one sixth(1/6th) part of total area that is covered by land. The 'Black cotton soils' covers an area, mostly consisting of the Deccanplateau region.Map shows that-Andhra Pradesh, Tamil Nadu(T.N.), Western Madhya Pradesh(M.P.), Gujarat Karnataka and few parts of Uttar Pradesh(U.P), Bihar and Jharkhand are covered by this soil. 'Black cotton soil' which is a typical 'expansive soil' has got shrink swell behaviour , i.e., it swells in the presence of water and shrinks when it becomes dry. Consequently its strength parameters are uncertain. This behavior is due to the presence of montmorillionite, a mineral which has got a typical structure in which gibbsite sheet of 10 A^0 is followed by silica sheet of the same thickness. Again it is followed by a gibbsite sheet and in between 2 such units water is entrapped, which is the root cause of problem.

In This review paper section I contains the introduction, section II describe the related work, section III explain about Methods of Stabilization of Expansive Soilsl, section IV contains the Admixture Stabilization details, section V contains the details about Rice Husk Ash, section VI describe the Uses of Rice Husk Ash, section VII describe the Rice Husk Ash Soil Stabilization, section VIII provide conclusion of this review paper.

1. RELATED WORK

1.1 Solution to Several Problems

The rules for the deliberate and legitimate segment of treatment and additionally mix of medications that limit the volumetric change viably and at the same time the related harm to the structures ought to be thought of simply after the far reaching soil(s) has/have been described.
The accompanying healing measures are utilized with various level of accomplishment.

2.2 Removing the Expansive Soil Entirely

1) In this technique, far reaching soil is expelled to an impressive profundity and then channel is inlayed with sand or potentially any dirt that does not swells. This technique gives a granular fill around the foundation(s), that aides in capturing a few developments that may demonstrate to be hazardous, in the event that water achieves the establishment.

2.3 Providing Reinforced Concrete Bands at Plinth Lintel Levels

2) Arrangement of 'strengthened solid groups' is for the most part received to capture the developments. Except if the vertical segments are given moreover at reasonable interims, it doesn't fills the principle need of limiting the occurrences of breaking.

2.4 Application of Surcharge Pressure

In low swelling soils, on the off chance that such soil is stacked with weight that surpasses the swelling weight; at that point the event of swelling of soil can be limited.

2.5 Preventing Access of Water to Soil

On the off chance that we can counteract dampness change in the dirt to any degree/limit, at that point the volumetric changes can be decreased or limited. Water films are turning into an undeniably encouraging in techniques for constraining access of water and limiting dampness changes, especially in street and asphalt development.

2.6 Pre-Wetting the Soil

The fundamental goal of this strategy is to permit dried up swelling soil to achieve the harmony before the arrangement of roadway (or) structures. Beating done to quicken swelling by this strategy, is a genuine model.

2.7 Soil Stabilization

Definition: To deliver a dirt material which is improved and has all the adjusted/wanted building properties, we do adjustment of soil by mechanical or concoction implies.

Soils are normally balanced out to expand their toughness and quality and to build the 'structure life period'.

2.8 Principles of Soil Stabilization

- Assessing the properties of soil of land territory under thought.
- We choose the property of soil that should be adjusted, to get the structure worth and afterward pick the best practical strategy for adjustment which demonstrates to be powerful.

2.9 Advantages of Stabilization

- It improves the dirt quality, along these lines expanding the 'dirt bearing limit'. This improves the strength and functionality of the dirt.
- It is considerably more conservative, both regarding vitality and cost and expands the bearing limit of the dirt instead of giving pontoon establishment or profound establishment.
- Inclines and other such places are settled. It forestalls the disintegration of soil.
- 'Adjustment' makes the dirt water evidence. By balancing out the dirt, we can anticipate access of water and thusly help the dirt to recover its quality.
- It helps in decreasing the volumetric change in the dirt because of progress in dampness as well as temperature.

2. Methods of Stabilization of Expansive Soils

To keep away from the swell - shrivel conduct of far reaching soil(s), the dirt should be settled by utilizing different techniques.

There are two strategies to settle the dirt:

- Mechanical Stabilization.
- Admixture Stabilization.

2.9.1 3.1 Mechanical Stabilization

In this sort of adjustment, compaction is done or in some cases stringy and other nonbiodegradable fortifications are added to the dirt. Mechanical adjustment does not include any sort of synthetic change(s). Various strategies used to accomplish mechanical adjustment

3.2 Compaction

In compaction, a substantial weight is utilized to expand the thickness of soil, by applying the weight from top opposite way. Machines, for example, vibrating steel drums in huge soil compactors, are every now and again utilized for compaction. Thus, compacting the dirt past its breaking point ought to be maintained a strategic distance from and alert must be taken supposing that the compaction is done past reasonable cutoff, the totals get squashed and the dirt loses its essential designing properties.

3.3 Soil Reinforcement

Soil issues are now and again illuminated by the built or non-designed mechanical arrangements. To trap the dirt, 'Geo-materials' and 'built plastic lattices' are planned and they help to control soil disintegration, soil penetrability, and dampness conditions. Bigger totals, for example, stones rock, and rocks are utilized where unbending nature and some extra mass can avert the relocation of soil or improve the heap - bearing properties.

3.4 Addition of reviewed total materials

Including those specific totals that give/loan alluring qualities to the dirt, for example, diminished versatility or expanded quality; is one more strategy to alter the properties of the dirt . This strategy is affordable, regarding utilization of material. It goes about as a base for the remainder of the structure, and furthermore improves the ability of sub-evaluation to go about as a help top.

3.5 Mechanical Remediation

This has been the acknowledged customary routine with regards to managing sullying of soil. 'Mechanical remediation' includes migrating the debased soil (by physical expulsion) to a dangerous dump yard, far from the provincial and/or urban populace . Be that as it may, as of late, bioremediation and concoction remediation have given a superior answer for this issue; both monetarily and naturally.

3. Admixture Stabilization

Building properties of the dirt can be improved by including synthetic substances or any such material that aides in adjustment of the dirt. By and large, this is a less expensive and successful system. Ex.; Importing total for some fixed thickness of base course costs more than the expense of transporting and handling a 'settling specialist' - like, soil bond utilized for treatment rather than soil material.

Added substances can be mechanical, that is their heap bearing force pads/supports the building properties of the dirt. They can likewise be substance, i.e., they respond with or change the compound properties of the dirt in this way changing the conduct of the dirt.

- Cement adjustment.
- Fly Ash and its variation like RHA adjustment.
- Bitumen adjustment.

4.1 Lime Stabilization

On expansion of lime to the dirt, the dirt gets balanced out. It helps in the adjustment of clayey soils. The pliancy of the dirt increments, when lime responds with soil. The subsequent material is more friable(that can be disintegrated effectively) than unique dirt. Such coming about blend fills in as a decent sub-grade.

Consuming of lime stones in ovens produces lime. The nature of the parent material decides the nature of the last prouct, ie lime.

4.2 Cement Stabilization

Added substance utilized for soil adjustment utilizing concrete is 'Portland bond' . In the event that relieving and compaction is done appropriately and additionally fitting proprtion of water is added to concrete, at that point

we can utilize this adjustment strategy. Practically all dirts can pick up advantage of concrete adjustment.

4.3 Fly Ash and its variation like RHA Stabilization

'Fly slag' is a substance added substance comprising of primarily silica and aluminum mixes. It is a side-effect of-ignition of coal. 'Fly fiery remains' is blended with lime and water to settle granular materials with few fines, subsequently creating a hard and bond like mass. Its job in the balancing out procedure is to go about as a puzzolona. It is utilized to fill the fine holes and it is efficiently accessible as it is only a waste thing.

4.4 Bitumen Stabilization

Bitumen is a remaining material acquired after 'partial refining' of unrefined petroleum in oil industry and is broadly utilized for soil adjustment. Significant impact of bitumen adjustment is somewhat more grounded soil increasingly climate safe and improved qualities, with a restriction that bituminous adjustment is reliant upon regular varieties. Termite related issues assuming any, are additionally expelled to certain degree.

5 Rice Husk Ash

'Rice Husk' is a result acquired from rice plants. Whenever arranged for what it's worth as land fills or else, it is a natural danger. On consuming, it makes puzzolonus impact. Roughly 22% of the paddy is rice husk, ie, external spread. It has got unpredictable natural issue and a piece of it is slick, which on extraction is known as 'rice grain oil'. This oil supports consuming of 'rice husk'very effectively, which is changed over to puzzolonic slag, which is known as 'Rice Husk Ash(R.H.A.); and in light of its puzzolonic properties it very well may be utilized in added substance improvement of far reaching soil.

In light of wealth of paddy generation in India, in its northern states and southern states, Rice Husk is additionally created in plenitude and the creation is to the tune of 24 million tons around; which when not tackled appropriately can be major natural danger.

Rice Husk Ash (R.H.A.) is pozzolanic, an acknowledged hypothesis by the analysts. The utilization of R.H.A. as a part in cementious materials depends on its response with lime, that structures solidifying material. The mechanical quality advancement is affected by the idea of silica, carbon rate and the fineness of powder. Scientists are considering over approaches to arrange them by utilizing 'Rice Husk Ash' (R.H.A.) economically.

6 Uses of Rice Husk Ash

6.1 In Lightweight Fill

The R.H.A. is a very good light-fill material, if the 'moisture content' is within permissible limits and can be compacted easily. It has got a very high frictional resistance with low cohesion, ie, why it should be used in tandem with some cohesive material to give desired results. High angle of internal friction makes it stable. It may shear under heavy rolling, if used alone. That is why it is always recommended to use it with some cohesive material, either in some alternate layers or with mixing it.

6.2 As a Stabilizer

R.H.A is obtained by burning Rice Husk and contains silica and calcium and is having certain puzzolonic properties but these properties are not in the same proportion as in fly ash. When mixed with expansive soil, and appropriate amount of water, the solid hard masses created and improvement takes place. It has got high improvement potential, as a stabilizer.

6.3 Other Uses

Its low density and high permeability with a variety of compactions at different moisture contents and also small pore size makes it a very suitable material to be used as a water filter in water supply coolings.

7 Rice Husk Ash Soil Stabilization

In additive stabilization, Rice husk can be used as single additive, causing major alterations in geotechnical properties of expansive soil and subsequent improvement in its engineering properties. On addition of R.H.A., LL and PL increases, while, Plasticity Index decreases. OMC is increased, while there is a marked reduction in MDD. Since inter frictional resistance , RHA is more on its addition to expansive soil , Frictional resistance of resistive soil is also increased, making it a cǿ soil. And its shear strength is increased resulting in consequent increase in unconfined compressive strength and CBR values, which are indirect measures of shear strength.

8 CONCLUSION

The main objective to use R.H.A. is to reduce the burden of 'waste material' which can be very effectively done by using it as a 'soil stabilizer' by- partially replacing the soil with RHA. Since R.H.A. is lighter in weight, it can be used very effectively for backfilling along with soil as well as in making the sub-grade of the roads; and if it is added to it, it will have a water proofing property as well. The M.D.D & O.M.C of R.H.A. – soil mix decreased and increased respectively, with increase in R.H.A. content in the soil. The period of curing is yet another factor on which the hydration depends. Hence the strength may increase if the period of curing is increased. It can be another parameter for our investigation. Subsequent upon the stabilization, with RHA, compressive and tensile strength parameters are considerably increased amounting to 4 times increase in strength. The shear strength of the soil increases by the addition of- 'rice husk ash mixture'. The results of the study revealed that- 5 percent replacement of soil by Rice husk ash(R.H.A.) not only makes the stabilization-'economical', but also improves the 'strength of the soil' .

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